The Hungarian Technology Foresight Programme

PROTECTION AND DEVELOPMENT OF THE NATURAL AND BUILT ENVIRONMENT

Panel Report

BUDAPEST

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In 1998 the National Committee for Technological Development (OMFB) launched a technology foresight programme named TEP after its Hungarian acronym. The main objective of the programme was to make a contribution to improving the long-term competitiveness of the country's economy. This would enable new opportunities to be identified in the development of both the market and technology that would improve the quality of life of the population. By analysing major changes in the economy and society as well as new achievements in science and technology, TEP defines the key issues and the areas where strategic decisions need to be made that will be crucial for the country's development in the next 15-25 years.

The Steering Group and the thematic panels have assessed the current situation, outlined different scenarios for the future, and formulated their recommendations to implement the favoured approach.

The thematic panels analysed the key aspects of the following, closely interrelated areas:

- Human resources (education and employment)
- Health and life sciences
- Information technology, telecommunications and the media
- Protection and development of the natural and built environment
- Manufacturing and business processes
- Agribusiness and food industry
- Transport

The TEP reports, analyses and findings of the Delphi survey may be accessed electronically via the home page of the Hungarian Ministry of Education at the following web site address: http://www.om.hu.

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Introduction

The general goal of TEP is not to describe the future in concrete terms, but to identify crossroads where the development of given sectors can take a turn for the better or for the worse.

Based on the present state of the Hungarian environment, the panel set out three possible development alternatives for the next 20 years. The panel also formulated recommendations with a view to bringing about the most favourable scenario for the future.

During the TEP exercise it was found that issues and tasks relating to the environment arose in most of the thematic panels. This sector may therefore be considered a horizontal one within the programme. Agriculture, healthcare, energy and transport are interrelated with environmental issues in many respects. During the entire period in which the TEP was under way, we applied a matrix-type approach that took the form of joint discussions with other panels, joint analyses of different issues, cooperation in devising and assessing Delphi questionnaires and harmonisation of the panel reports.

A snapshot

The State of the Environment in Hungary

Resolution No. 83/1997 (IX. 26) of the Hungarian Parliament defines and regulates the tasks and implementation of the National Environmental Protection Programme. The Programme sums up the present state of the natural and built environment and the major factors influencing their quality as follows:

Air

3.9 per cent (i.e., 3,590 km^2) of Hungary's territory can be classified as 'polluted', and 9.3 per cent of it can be considered 'moderately polluted' (8,674 km^2). However, almost half of the population lives in these areas, which constitute only 13 per cent of the total territory of the country. The most important problems with regard to air quality are the following:

- Air pollution levels around the greater Budapest area and in the industrial areas of the Northern Trans-Danubian region are exceptionally high. Both regions can be considered contiguously polluted areas.
- Over the past decade both sulphur dioxide and nitrogen oxide emissions have been reduced in the country. However, the ratio of nitrogen oxide emissions from transport has increased. Motor vehicle emissions play a significant role

in the air pollution of large cities and areas adjacent to public roads with heavy traffic.

- During the summer, the ozone concentration at the surface in certain cities exceeds the allowable level many times over.
- Lead pollution is decreasing in Hungary. (This is one of the most significant achievements in domestic environmental protection over the past few years.)

Water resources

Due to Hungary's basin-like geography, the average per capita volume of water flowing through the country is one of the highest in the world.[1] Hungary is characteristically a transit country from a water-management point of view, too, since her water resources – in both quantitative and qualitative terms – are dependant on the actions taken in neighbouring countries.

Surface waters: periodic formation of algae in the River Danube keeps increasing, while bacterial pollution of the Danube shows no sign of decreasing. The level of nitrate concentration in the river's water is growing year by year, and pollution levels exceeding 20 mg/l are not uncommon at present. In the River Tisza, while most water quality indicators are improving, ortho-phosphate pollution has increased considerably. In Lake Balaton the increasing environmental burden on the nutritive base of the water has been halted as a result of the measures taken over the past few years. The key factor in eutrophication is phosphor. In the Great Hungarian Plain, channels built mainly for irrigation purposes are in many cases also used for municipal sewage drainage. The utilisation of waters polluted in this way for irrigation purposes is undoubtedly limited. It is a major polluting factor that the proportion of households connected to running water pipelines was 91.1 per cent in 1998, while the same indicator for households with sewage drainage was only 47.6 per cent. The length of sewage drainage channels per one kilometre of running water pipelines was 341.6 metres in 1998. Most sewage water is not treated or is inadequately treated. The problems are especially severe in the capital and some of Hungary's larger cities.

Underground water resources: these are vital for preserving the basic conditions of life. Underground water plays an important role in the drinking water supply and in balneological applications. In the second half of the 1990s, extensive cyclic rains occurring mainly in the eastern and north-eastern parts of the country led to a considerable increase in groundwater levels. In Szigetköz, due to the diversion of the Danube, the level of groundwater has decreased. By the end of the 1980s, the karst-water levels in the Trans-Danubian Mountains were sinking by as much as 1 metre per year on average, and in certain areas by even more. The depression on average was 30m, while in certain areas it amounted to 100 metres. Pollution of underground water resources, as measured by standard component indicators, is shown first of all by the increase in nitrate concentration, which is mainly due to the lack of sewage drainage on animal breeding farms and the negative effects of chemical and organic fertilisers.

[1] The volume of inflowing water is 116.3 billion m3 per year; while that of outflowing water is 129.0 billion m3 per year.

Soil

Protection of the soil includes (preservation and rehabilitation of) the land surface, underground strata, rocks and minerals. Hungary's relative potential is special by comparison with most European countries, since 85 per cent of the land is suitable for agriculture or forest cultivation. Most of the remaining 15 per cent of Hungary's territory is covered by built environment. In addition to agricultural use, waste-assimilation capability is also an important factor in soil quality. With regard to preserving natural resources in this field, erosion due to water and wind constitute the major problems. In recent decades, acidification of the soil has continued due to acid rain and improper use of chemical fertilisers. Furthermore, land surface and soil pollution occurring as a result of urban, industrial and agricultural activities also pose considerable problems although these vary in extent from one region to the next.

The environment of settlements (habitation) is an artificially constructed material system created by people to satisfy the needs of everyday social existence. The major challenges affecting the quality of the built environment are the following:

- In some areas of the county the condition of buildings, urban infrastructure and public hygiene is deteriorating. Especially in economically declining regions, this problem is accompanied by worsening quality of life.
- Air pollution from industrial activities and transport endangers whole settlements or city districts.
- The rehabilitation of former industrial sites has not yet been resolved. Instead of rehabilitation new, greenfield investments are carried out that reduce the area of the natural environment, increase urban sprawl and increase transport requirements.
- Environmental pollution caused by transport is the most difficult to cope with, and it has become a serious problem for the urban environment, with negative effects on public health.
- The relative size of green areas in inhabited areas is below that needed, while existing parks are often untended due to the deficiencies of maintenance.

The state of the environment is a major factor affecting human health. The share of cases of malignant tumour illness due to environmental pollution is very high in the mortality statistics, both nationally and internationally. Among different causes of morbidity, the increase in head, neck and lung tumours is especially alarming. A propensity for allergies is characteristic of a large portion of the population, reaching the 40 per cent level. Recorded instances of morbidity related to asthma and bronchitis grew to 13,718 by 1998 from its level of 3,820 in 1980.

The built environment – buildings, structures, public infrastructure, squares, streets and human settlements – is a valuable, enduring part of the national assets. Major problems affecting its present condition are: the deterioration of housing, public buildings and sites, the demoralising effects of decreasing aesthetic quality; worsening living conditions in the urban environment and the deteriorating condition of national landmark buildings and sites.

The state of the natural environment

Nature conservation aims at preserving the animate (living) and inanimate (non-living) assets of nature. One of its main goals is to preserve biological diversity, which is based on protecting and securing the 'normal functioning' of nature and habitat. There are only a few intact natural areas left in Hungary, since its forests, meadows, hayfields and grazing lands have been cultivated for many centuries. The number of endangered species of flora is 730, while that of the fauna is 400. Wetlands – in addition to natural desiccation and biological degradation resulting from human activities – are most endangered by industrial pollution. The share of forest land in the total territory of the country was 18.7 per cent in 1998. Due to inadequate forestry management policies as well as to the profit-making interests of the businesses concerned, fast-growing tree species were given preference in forest plantation. In many cases valuable, indigenous tree species have been replaced by these. The area occupied by meadow and grazing land has also decreased considerably due to other forms of agricultural land utilisation (e.g. farming, forestry and fisheries) as well as due to industrialisation, urbanisation and transport. The disappearance or degradation of mountain and hillside meadows once rich in flower species is one of the most alarming indications of the biodiversity problem.

The Hungarian landscape is characterised by a balanced diversity of types of terrain, hydrographical conditions that reflect the country's basin-type geography, diversity of flora and fauna resulting from her geographical location and special settlement structures shaped over many centuries (e.g., the detached farms and agricultural towns of the Great Plains or the tiny villages and towns of the Trans-Danubian region). The major land preservation problems, which are interconnected, are the following: decreasing capacity (yield) of natural and agricultural production and declining ability of the soil to adjust to the burden of pollution, degradation of natural assets, decay of characteristic elements of the local landscape and decline in the aesthetic quality of the landscape (e.g., Lake Balaton and surface mines).

Close to 114 million tons of waste is produced yearly in Hungary. Of this, 4 million tons per year is municipal solid waste and 20 million tons per year is liquid municipal waste undergoing treatment. The remaining amount of waste, i.e., 90 million tons per year, comes from industrial, agricultural or other economic activities. The amount of hazardous waste was 3.6 million tons in 1998.[2] The amount of industrial waste is decreasing, while that of municipal waste is slightly decreasing. The major problems characterising waste management are the following:

- In Hungary there is no reliable information system on different types of wastes.
- Collection of solid municipal waste is not comprehensive.
- There are a number of legal and illegal waste disposal sites around the country that are potential sources for environmental pollution.
- Free disposal capacities are decreasing while advanced methods and technologies are not widely used in waste disposal.
- Sewage water purification sites are inadequate for liquid municipal waste disposal. (Liquid waste is mostly disposed of through sewers, at solid waste

[2] In 1991 this indicator was 4.4 million tons.

disposal sites and technically inadequate cisterns, or ends up directly in the countryside).
- The amount of industrial waste is unreasonably high; application of low waste technologies and production systems is not widespread.
- Capacities for treatment of hazardous waste (neutralisation) are scant.

One of the greatest challenges for humankind is to achieve global, regional and local safety and, as a part of this, to create the guarantees of environmental safety that ensure sustainable development. Environmental safety is given high priority at the most important international forums. Environmental safety in Hungary is to a great extent determined by industrial activities, especially by those of chemical plants. Their technical systems of safety control need to be improved, while more attention should also be paid to risk assessment as well as to the conditions and regulations pertaining to hazardous waste transportation. The environmental monitoring system is fragmented; there is no central institution for environmental safety/security information that could serve as a gateway to the existing European centres or systems.

Environmental policy

Law No. LIII of 1995 and the relevant regulations relating to it form the legal basis and framework of Hungarian environmental policy. Harmonisation with the EU is a major consideration and driving force in setting Hungary's regulatory framework on the environment.

Public administration and institutional structure of environmental protection

The highest-level government body concerned with environmental protection in Hungary is the Ministry of Environmental Protection (MEP), which is responsible for setting and implementing environmental policy. Major responsibilities of the ministry include protection of the basic elements of environment (water resources, air, soil, etc.), waste management and nature conservation. Other ministries also have certain environment-related responsibilities.[3] The National Environmental Protection Council functions as an advisory body to the government. Its members include representatives of the scientific community, the business sector and 'green' community groups. The Committee on Sustainable Development functions as a discussion forum for different environmental protection initiatives.

The top-level authority for environmental protection is the National Inspectorat for Environmental and Natur Protection, which operates under the supervision of the Ministry of Environmental Protection. There are twelve regional environmental protection authorities in Hungary, and these hold the prime responsibility for

[3] For example, the Ministry of Transport and Water Management is responsible for water management; the Ministry of Health is responsible for health-related environmental issues and the Ministry of Agriculture and Regional Development holds responsibility for forestry mangement, while the Ministry of Education covers environmental education.

enforcement of the relevant regulations and norms, and for issuing authorisations relating to environmental protection. Monitoring environmental pollution is also one of their responsibilities.

Local governments (municipalities) also have environmental protection responsibilities, for example in the field of sewage water, waste treatment and environmental management. Municipalities are responsible for defining and protecting local natural park areas as well as for setting regulations for local air quality control and enforcing the standards set.

Environmental education and training

In the first half of the 1980s, the National Institute for Pedagogy distributed to all elementary schools its educational material containing the basics - in both methodological and curricular terms - on environmental awareness-raising and education. An optional course on 'Humans and their environment' was introduced into elementary schools in 1993. Efforts to link 'stand-alone' environmental education centres to form a network started at the same time. In higher education, environmental protection was first introduced into the curriculum of teachers' training colleges, while in other professions (e.g., engineering and economics) special environmental protection courses were started in postgraduate education.

The 1990s brought about dynamic developments in environmental education and training. As a part of this, environmental awareness-raising and education was institutionalised across all levels of education, ranging from kindergartens to higher education institutions. New educational programmes introduced into schools of engineering and economics (training of environmental engineers and human ecologists as well as educational pathways for engineers of environmental technologies and environmental biology) laid the foundations for the spread and proper management of environmentally friendly technologies.

Environmental R&D and innovation policy

Domestic research and development on environmental protection includes the fields of the natural and built environment and meteorology, covering R&D, technology development, standardisation and quality control. The research institutes of the Hungarian Academy of Sciences, universities, government research laboratories and R&D units of enterprises provide the institutional basis for these innovation activities.

During the years of the transition to a market economy, foreign direct investment and imports were the principal driving forces of innovation and technology upgrading. Foreign investments were accompanied by an 'automatic' transfer (import) of advanced environmental technologies and manufacturing methods. Meanwhile, domestic R&D was characterised by declining expenditures in general, including the field of environmental protection.

Environmental industry in Hungary

Investments in so-called 'end-of-pipe' industries and integrated (complex) environmental protection accounted for 0.8 per cent of the country's GDP yearly in the 1990s. More detailed data on environmental protection investments are provided in Table 1.

Table 1: Volume of environmental protection investments by function in 1998 (HUF millions)

Investment objectives	Volume of investments		
	Direct	Combined	Total
Sewage water purification	38,280.9	10,180.7	48,461.6
Protection of groundwater and underground water resources	3,788.5	1,355.1	5,143.7
Protection of air quality	6,106.3	8,332.9	14,439.2
Waste treatment	7,681.6	1,987.7	9,669.3
of which:			
Treatment of hazardous waste	1,355.5	426.9	1,782.5
Waste collection and transport	3,977.3	547.4	4,524.6
Protection against noise and vibration	708.4	668.3	1,376.6
Protection and conservation of nature	2,615.4	187.0	2,802.5
of which:			
Protection of surface water resources	1,478.8	94.7	1,573.5
Protection of forests	141.5	-	141.5
Other	1,768.3	460.6	2,228.9
Total	60,949.4	23,172.4	84,121.8

Source: Hungarian Central Statistical Office, Budapest, 2000

Within the environmental industry, the service sector is the most developed segment in Hungary. Within the environmental service sector, meanwhile, controlling, monitoring and analysing activities are especially strong (157 firms operate in these fields). Technical and engineering services are also well developed (82 firms).

In environmental protection equipment manufacturing, water purification technologies and treatment technologies/tools for other liquid waste represent the majority. However, the number of companies involved is relatively small (30). In the environmental equipment manufacturing industry the second largest segment is waste treatment and recycling equipment (18 firms). Companies specializing in recycling technologies/products and clean technologies represent the majority of this industrial segment. In comparison to the market segment the number of domestic companies manufacturing equipment for air quality control and pollution prevention is unreasonably low. This segment of the domestic market is covered by a small number of multinational companies. International agreements on reduction of air pollution and ozone-depleting gas emissions (e.g., the International Agreement on Climate Change and the Montreal Protocol) will most probably provide a boost to this sector in the medium term. International trade and technology transfer will likely increase in this field. The manufacture of noise-preventing and noise-decreasing devices as well as

equipment for noise-level monitoring, measurement and research is also limited in Hungary. In these fields it is almost exclusively imported equipment that is used in Hungary.

The majority of companies manufacturing environmental protection technologies and equipment are small and medium-sized enterprises. Of the environmental protection companies in western Europe, only 47 per cent of firms survive more than five years, and only 35 per cent continue in operation after the 10th year. A precondition for survival is to have a vertical presence in the market, meaning an operation that spans the whole 'life cycle': planning, assessment and consultation, followed by implementation and installation and finally, services. In the environmental protection industry a further concentration process is expected to take place internationally, especially in waste management, energy-related environmental technologies, water management and recycling. In these market segments a turnover of 100 million USD per year seems to be the 'critical mass' for survival. The turnover of domestic companies surveyed in the TEP exercise barely reaches 1 per cent of the above volume. For small and medium-sized companies – in spite of fierce competition – market segments in the service sector ('critical mass' of annual turnover: 2-3 million USD), devices for environmental analysis and laboratory equipment (5-6 million USD) and special environmental technologies (7-8 million USD) offer good opportunities for the businesses to survive.

When developing domestic business strategies, it is of utmost importance to take into account international lessons and trends. There are good market opportunities in joining the suppliers' network of large companies (international or domestic), offering complex environmental protection products or services. Strengthening the ability of small and medium-sized domestic enterprises in this sphere should be one of the top priorities of Hungary's environmental policy.

Future scenarios

Methodology

For devising future scenarios our panel defined two variables. One of them was globalisation or, more specifically: impacts of global economic changes and their environment-related tendencies on Hungarian society, economy and environmental protection. Hungary's accession to the European Union seems to be just a question of time, so the first variable follows and depends on the state of the environment in the EU region as well as its relevant strategies and regulations. The other variable is the position of environmental protection in the domestic value system, actions and trends. Success or failure in this case depends on whether Hungary chooses the principle of sustainable development for the country's social and economic development in the next 20-25 years as a high priority or it remains a low-key issue.

Limiting the scores to their two extreme values, four possible scenarios can be outlined (see chart below). Of these four scenarios the Panel found three to be 'rational' and elaborated these in detail. In theory the fourth version, when the environmental programme of the EU is unsuccessful, but sustainable development enjoys a high priority in Hungary, is also conceivable. However, the probability of such a scenario was considered very low by the Panel, and consequently this version was not dealt with in depth.

	Environmental programme(s) of the EU	Sustainable development in Hungary
A Chance for Sustainability	Successful	a priority
East of Eden	Successful	not a priority
Weed and concrete	Not successful	not a priority

Scenarios

Scenario 1: 'A Chance for Sustainability'

According to this scenario the European Union, enlarged to include a number of new members, strengthens its competitive position vis-à-vis the North American and Asian economic centres. An enlarged internal market and increasing research and development expenditures lead to an economic growth rate that exceeds the world average. Dynamic development of environmental industries and the spread of clean technologies serve as engines for this rapid economic growth. In the utilisation of economic and social resources a shift takes place in favour of human resources. The knowledge intensity of products and services increases and the relative role of natural resources, which represent a significant share of currently used resources, decreases.

Hungary becomes a member of the European Union by 2005 at the latest. As a member of the EU it enjoys the advantages of technology developments unfolding throughout the continent. Gradually more and more domestic companies adopt environmentally friendly and clean technologies; the economy and the market reject obsolete and polluting technologies. Amongst the priorities of business and technology development strategies, environmental protection enjoys increasing weight.

The status of the country both in general, and as regards its policies concerning the natural and built environment, become similar to those of the countries at the forefront of the EU's 'cohesion group' (Ireland, Portugal, Spain and Greece), with specific features characteristic of a Central and Eastern European country. The new EU members form a Central and Eastern European cohesion zone (Poland, the Czech Republic, Hungary and Slovenia and possibly Estonia), which - albeit with some initial delay - follows the principles and practice of sustainability that characterise the average EU countries.

The decrease in environmental burdens, the increase in environmental safety, more balanced regional development and, simultaneously, the increase in people working close to where they live (with a concomitant reduction in pollution resulting from transport) resulting in a substantial decline in the damaging effects on health related to environmental pollution.

As a result of the development in information technology and telecommunication technologies, new opportunities are emerging for education and work from home. However, the disposal of obsolete computer and telecommunications tools and their components pose a growing problem in waste management.

The country embarks on the path of progressive adaptation; in other words, Hungarian companies follow the more environmentally sensitive international development models. As a result of steady development, Hungarian companies achieve a higher level of environmental 'performance', first catching up with the European level, then maintaining their top rank in environmental protection in the long run.

GDP-specific waste substantially decreases. The economy undergoes an advantageous restructuring, and the weight of material-intensive and high-waste industries decreases. The share of hazardous materials in produced waste decreases, while conditions for their safe disposal and neutralisation improve.

In the agricultural sector a production shift takes place in favour of organic products, organic and environmentally friendly processes and methods. This reduces the demand for and use of chemical insecticides and fertilisers, leading to a reduction in the environmental burden on the soil. At the same time, traditional agricultural production methods remain predominant, though their relative weight decreases. The situation regarding biodiversity does not deteriorate further. A considerable shift may take place in the use of renewable energy resources and their share in the total energy supply could reach 10 per cent by the end of the given time-period. In energy supply the role of solar energy, at present considered an alternative source, continuously increases, while at the same time biomass is also used more widely as an energy source.

While shifting to new technologies, companies give preference to energy-saving and material-saving technologies. Preventive methods and processes enjoy preference over the so-called 'end-of-pipe' filtration technologies.

Consumption takes on a new meaning, its 'content' is re-valued; lifestyle plays an increasing role in the quality of life. The external costs of health damage occurring as a result of environmental pollution (that is, costs not paid by the polluter) are no longer met by the central budget, but – based on the principle of 'the polluter pays' – are paid by the polluting companies.

The role of the public in solving environmental problems increases. The population accepts the key principles of sustainable development, such as care, prevention, subsidiarity and 'the polluter pays'. Providing adequate information for the population and involvement of citizens in decision-making processes becomes general practice, which contributes to preserving and improving the state of environment.

As a result of increasing energy efficiency, environmentally friendly transport and cleaner production, pollution decreases and this has a positive effect on the population's health. The quality of the indoor air in housing units also improves, though this has only a slow impact on health conditions. It is likely that the use of relatively more polluting gas heating systems decreases, while the spread of alternative heating systems (e.g., solar energy, heat-pumps and geothermal energy) lead to a reduction in air pollution. The quality of housing units also improves (e.g., due to better heat insulation). The number of acute cases of respiratory illness and mortality due to these are likely to decrease. Short, but high-intensity pollution events (e.g., smog) become less frequent, so there will be less need for acute interventions. Drinking water pipelines are already widespread in the country today (85-97 per cent.) This ratio will reach close to 100 per cent, which, in addition to drinking water supply, improves the general conditions of public hygiene. Improvement of the quality of recreational waters results in a decreasing number of allergy cases.

Stakeholder organisations play an increasing role in responding to both local and national environmental challenges. They initiate and take part in the implementation of local and national programmes aimed at sustainable social, economic and environmental development. With the involvement and professional and financial support of domestic stakeholder organisations, joint thinking and cooperation with the neighbouring countries is strengthened (e.g., protection of the Carpathian Basin, the Danube region and forestry). This international cooperation contributes a great deal to enhancing local capabilities in implementing projects supporting sustainable development. Stakeholder organisations have better chances of obtaining government financial support. Their financial resources are reinforced by donations from members of the public and companies that are far in excess of the amounts donated at present.

International integration of Hungary helps gradually to spread a positive attitude towards the environment. In environmental education and training, complex programmes and forms of education become widespread. Emerging environmental education/training centres that enjoy government support become regional centres for environmental awareness-raising. Developing environmental awareness becomes a cornerstone of the education system, even at the lowest level (kindergartens) and the highest (universities and postgraduate education). The education system accepts environmental protection as an intrinsic part of the curriculum so that, for example, the curriculum also includes knowledge regarding the environmental aspects of any given profession. The education system also provides the basis for environmentally friendly thinking and living.

Differences in regional environmental burdens decrease substantially as a combined result of the increasing role of the regions, the cleaning up of polluted sites, stricter enforcement of the provisions of international agreements and harmonisation with the EU norms. Hungary's integration into the EU facilitates regional integration within the country. The role of micro-regions and micro-communities in solving environmental problems increases. The EU principle of 'subsidiarity' prevails in Hungary too. In regional development, environmental protection in agriculture enjoys a preference, which is fully in harmony with the EU's regional development policy.

Scenario 2: 'East of Eden'

According to this scenario, economic growth continues in the European Union, but its relative position in the world economy deteriorates to some extent. In spite of the latter, the EU implements its sustainable development programme. The (structural) funds of the EU grow only slowly due to the resistance of donor countries and strong persistence of the 'cohesion countries' that joined earlier to preserve their previous level of support from the funds. The catching up of the Central European countries proceeds slowly.

Hungary joins the European Union after 2005, but the practice of 'sustainable development' undervalues the principles of 'sustainable development' and considerably hampers their social and economic implementation. Due to the aforementioned lack of resources, the EU takes a 'liberal' stand on the derogation needs of the newly acceding countries: enforcing the strict environmental standards of the Union is only a 'soft' requirement. As a result, the country meets the requirements of the European Union in regulations, but it follows a soft implementation policy, since there is strong resistance among the population and companies alike. In environmental protection low-efficiency, 'end-of-pipe' technologies predominate.

The present structure of manufacturing and consumption changes slowly in the country. Per capita GDP expenditures on research and development increase at a slow pace, the country's economy is characterised by low value-added, labour-intensive activities carried out as sub-contract work. Energy efficiency improves slowly, while there are strong interests at work to increase energy production. Within personal consumption, material values remain predominant or even gain in importance with the growth of incomes. Due to weak implementation of the principle of subsidiarity, the role of municipalities in reducing environmental damage is only slightly strengthened.

A slow and spontaneous technology shift takes place towards cleaner production, which varies considerably in its extent among the different industries. The major driving force behind the shift to cleaner technologies is the continuing increase in the price of raw materials and energy resources, which slowly catches up with the European price level. Cleaner technologies spread mainly in export-oriented industries that have no choice but to adapt to the European market requirements and environmental standards (e.g., the machinery industry), while in industries selling their products on the domestic market polluting technologies continue to predominate (e.g., smaller companies in the food industry). Material-saving indicators improve; new products perform the same functions as the old ones but produce a lesser burden on the environment (e.g., energy-saving refrigerators and washing machines or more efficient petrol-driven engines).

The EU-conform Hungarian legal regulations prevent the country from inflows of above-average polluting technologies from the EU region. Nevertheless, regulations cannot entirely prevent manufacturing activities that meet the EU regulations, but against which the population of the EU countries protest, from relocating to Hungary.

According to this scenario, the amount of waste occurring as a result of manufacturing processes may decrease mainly in the hazardous waste category, while the amount of non-hazardous industrial waste and communal waste stagnates or slowly increases. There are certain efforts made in pollution prevention and waste recycling but no breakthrough is achieved in this area. Selective collection of waste takes place, not on the basis of the hazard posed but on the basis of the waste materials that can be selectively collected less expensively. Even so, however, it does not become general practice. The principal methods of waste management are disposal at dedicated sites and destruction by incineration. The technological level of the above activities is generally improved, and the network of regional waste disposal sites becomes more or less complete.

In terms of public health indicators, the tendencies of previous years continue to prevail; the mortality rate decreases slowly, while life expectancy increases only slightly, meaning that the gap between Hungary and the developed countries narrows only slightly in this respect. Amongst the factors determining air pollution, transport, emissions from power plants, communal heating and – to a lesser extent – other industrial activities play a major role. The amount of sulphur dioxide, nitrogen oxides and carbon dioxide emitted into the air decreases slowly. The air quality in towns and villages, which affects the populations' health most, is still determined by the road transport conditions. The living standard and housing conditions of the population improve. Due to gas heating, however, the indoor nitrogen dioxide concentration in housing units, which is high even today, is expected to increase further. The factors that most endanger health in people's living spaces are allergy-inducing pollutants that trigger 'hypersensitivity'.

Institutions responsible for monitoring and analysing the state of the environment and for taking the necessary measures to protect it (local governments, environmental, health care, water management and other authorities) operate with limited efficiency due to their fragmented structure and inadequate co-ordination.

The state of the environment does not improve or improves only slightly. Environmental pollution affecting human health does not decrease in general, or may even increase to a small extent. The number of cases of illness related to environmental pollution does not decrease: morbidity related to allergies, asthma, acute respiratory disorders and lung cancer increases.

In environmental education and awareness-raising the traditional, subsequent environmental protection prevails and no qualitative breakthrough is achieved in this area. The activities of environmental specialists, trained in increasing numbers, are limited to enforcement of regulations.

According to this scenario, environmental education and training are limited to a minimum level in public education. Curricula are only able to integrate teaching of environmental knowledge into subjects on natural sciences. Training of environmental specialists is limited to postgraduate courses and special forms of education. Environmental education and awareness-raising programmes and activities of the state school system and the community sector are not harmonised, while supplies of school

resources in this field are inadequate. The school system mostly reacts positively to growing environmental challenges, but the efficiency of environmental education and training is lowered by different social and economic factors and therefore its level falls short of the desirable. The country's environmental education infrastructure lags behind that of the European Union. The efficiency of environmental education is negatively affected by the 'harmony-deficit' of the public administration that constitutes the professional, legal and organisational background for such activities.

If the state of the country's environment stagnates and environmental issues come to the forefront of government policy more in declarations than in effective actions, then the so-called reactive forms gain primary importance in the activities of stakeholder organisations. The diversity of stakeholder groups' in terms of their activities, organisational structure and methods is preserved. Their role in preventing and eliminating environmental damage strengthens. Nevertheless, in spite of their will to influence economic trends and environmental policy-making, their efforts and the pressure they can exert fails to have the necessary impact and the results of stakeholder actions remain limited. It is expected that the number of environmental demonstrations will increase. The stakeholder sector puts a great emphasise on presenting citizens with alternatives, mainly in terms of their consumption and transport habits, methods of saving energy, healthy ways of life, leisure activities and organic farming.

Differences between the eastern and western regions of the country are reduced slowly. Mainly local natural and intellectual resources provide the basis for development. Even if only limited development were assumed, it would become necessary to establish regional environmental protection centres. Rational utilisation of natural resources and agricultural environmental issues in regional development are declared priorities. Due to inadequate implementation of the principle of subsidiarity, the role of municipalities in reducing environmental damage is only slightly strengthened. The environmental tasks of domestic municipalities are limited mainly to two areas: disposal and neutralisation of waste and sewage water purification.

Scenario 3: 'Weed and concrete' (lasting crisis)

The European Union lags behind the main economic regions of the world in terms of economic performance and competitiveness. In the world economy conventional market and trade methods remain predominant. Global and regional environmental conflicts intensify and continuous crisis management uses up considerable resources. In environmental protection the end-of-pipe technologies, which are the least efficient in both economic and environmental terms, dominate industrial applications.

Due to heightened contradictions in the world economy, the relative economic growth of the European Union slows down, while accession of the new members is delayed till around 2010 or even later. The position of environmental protection weakens in Hungary, and becomes subordinated to inefficient economic growth.

Due to economic necessity the danger of environmentally damaging technologies being applied in different industries increases. Environmental considerations are barely taken

into account in decision-making. Within the European Union Hungary plays a peripheral role, and this also determines the level of relocated technologies. Hungary becomes a haven for obsolete, polluting technologies. Heavy industry, the chemical industry and the paper industry are revived in Hungary since the more environmentally sensitive citizens of the EU's middle-ranking countries can hardly tolerate plants of these industries in their vicinity. The technological gap between Hungary and the middle-ranking countries of the EU remains lastingly unchanged or even widens.

A so-called 'degressive' process of European adaptation takes place: foreign owners adjust to the lower level of environmental culture in Hungary.

Agriculture is characterised by a changed ownership structure, but the farms are tiny in size, while the technologies and methods used in the sector are polluting to the environment. No success is achieved in counteracting the negative effects (mainly soil pollution) of earlier, polluting agricultural technologies.

Due to inadequate development of the transport infrastructure and to the transit character of the country, tensions and imbalances occur in the transport system: road development intensifies, while the role of railways and public transport weakens. The vehicle fleet becomes even more obsolete than it is today and its technical condition deteriorates.

Acknowledgement of non-material values and the level of environmental awareness are scant among the country's population.

The amount of waste increases. Illegal disposal of waste is widespread and conventional technologies predominate with regard to waste neutralisation. Recycling is almost non-existent. The amount of hazardous waste also remains high. Inappropriate disposal of waste leads to serious environmental pollution from time to time. Coping with such environmental damage places a considerable financial burden on the budget

In spite of the alarming state of the environment, the majority of the population pays insufficient attention to environmental problems. Most people do not understand the dangers resulting from the exploitation and pollution of environment and if there is a conflict arising between the economy and the environment, they prefer the economy to the environment.

Environmental education and training are very poorly represented in public education programmes. Institutions for training environmental teachers are vanishing. Environmental education is limited to knowledge transfer through classical natural sciences subjects. Environmental awareness programmes in the country are kept alive only by means of international financial support. Regulations on the operations and management of companies/institutions do not provide stimulation for measuring environmental performance or for employing environmental specialists. As a result, there is no demand for training programmes for environmental engineers and managers.

Although in some cases environmental regulations are equivalent in quality to those in the industrialised countries, most of them are not enforced due to inadequate social

control. As a result of inappropriate social, economic and environmental conditions and lack of self-confidence, the population does not support green movements and initiatives. Environmental organisations and groups are also to blame for this situation, because as a result of their ill-chosen tactics and actions they are unable to get the population or the authorities on their side. Their activities are mostly concentrated on protesting instead of elaborating and implementing appropriate programmes and development alternatives.

Differences in the environmental burden between the regions are increasing. As a result of the country's peripheral position, the development gap between the eastern and western regions widens. Environmental disadvantages resulting from this trend occur more markedly in the less developed and less competitive regions. Environmental investments decline further in the regions struggling with their competitive disadvantages (sewage water purification systems, regional waste disposal sites, waste neutralisation plants, etc.)

Recommendations

1. In order to strengthen regional development and environmental protection considerations in decision-making, it is necessary to establish regional environmental centres across the country.
   These centres should serve as bases for elaborating and implementing complex environmental protection and development programmes as well as for running environmental education and awareness-raising projects and information services.

2. In order to improve environmental health conditions, it is necessary to elaborate a comprehensive socio-economic strategy addressing the major problems relating to this issue. In devising the above strategy the following major indicators should be dealt with: increase in life expectancy, decrease in socio-environmental damage, and the spread of healthy lifestyles among the population. The programmes may be aimed at decreasing the negative environmental effects of transport, creating healthier conditions in housing units, counterbalancing the health risks posed by inadequate water supply, reducing environmental pollution at work and rehabilitation of environmentally damaged sites. Launching such concerted efforts should be carried out mainly in the framework of the 'Programme for a Healthy Hungary' initiative.

3. It is necessary to establish strong economic, legal and information frameworks that stimulate and facilitate the expansion of cleaner production. The most efficient way of supporting cleaner production is stopping the existing 'hidden' supports (e.g., VAT relief) for production that utilises raw materials and energy resources irrationally. Although they may lead to an increase in the price of raw materials and energy, these measures stimulate companies to be economical in the use of natural resources. For low-income social groups the burden of the price increase can be offset by a pension increase or other targeted social allowances (benefits). The spread of cleaner production processes, the so-called production-embedded

environmental protection technologies, should be facilitated by the establishment of an environmental protection data bank. This information service would provide data on top-level international environmental protection methods and clean technologies, including their major parameters, references in application and availability. This data bank should compile a list and provide information on clean production methods and technologies whose introduction and application may be eligible for support. Establishment of the country's legal and information basis (framework) for environmental protection is a government responsibility, while companies may also be willing to join as partners in starting reference projects and running them.

4. It is in our best interest to introduce new, more ecologically sensitive elements into the country's tax system, adding 'win-win' incentives to the range of available economic policy instruments.
   The environmental programmes of the European Union and its member states are characterised by three tendencies. a) Introduction of economic incentives into the regulatory system instead of using legal instruments that command or prohibit; b) eco-taxes become compensation-type taxes, while the whole taxation system becomes more ecologically sensitive; c) simultaneous application of horizontal and 'win-win'-type regulations. The ecologically sensitive tax system raises the prices of non-renewable natural resources and relatively lowers labour costs, resulting in a reduction of the environmental burden and of unemployment (a 'win-win' situation). In reshaping the tax system along the above lines, the 'polluter pays' principle should prevail, since environmental costs are supposed to be included in the market price of products and services. Preference of material- and energy-intensive economic activities by the tax and price systems should be eliminated. Creating an adequate legal framework for the above is the responsibility of the state.

5. Environmental education and training should be given a key role in environmental policy. Taking into consideration the present conditions and the traditions, educational centres belonging to national parks might become basic institutions of environmental education at elementary and secondary levels. To this end, these centres' existing intellectual and material resources should be reinforced. All training of environmental specialists and their career perspectives, as well as the environmental performance of companies, institutions and government organisations would be positively affected if the state provided some support for salaries of environmental specialists, functioning as an add-on pay to the wage provided by the employers. By taking over a wide range of government responsibilities, stakeholder organisations and professional associations in Europe and in Hungary play a major role in environmental education and awareness programmes. Taking regional considerations into account, these groups and organisations should be given targeted support by the government with the goal of enabling them to provide better services for the population, and to encourage their networking operations. To achieve these goals, intensive cooperation should be established between the community sector and the government administration. Within the latter the Ministry of Education should play a key role.

6. In urban (settlement) development, looser housing patterns should be preferred over the present dense structures, providing more space for the natural environment.

An urban environment (habitation) characterised by the above pattern has positive effects on the population's quality of life. It also helps to bring about a shift to more healthy ways of life and to improving the environmental aesthetics of settlements, while looser housing patterns and 'greener' neighbourhoods lead to lower pollution concentrations. It is advisable to let municipalities and local stakeholder organisations exercise jurisdiction and have the final say in settlement development issues.

7. For taking concerted measures in the event of catastrophes occurring in the built or natural environment, the Panel advises establishing a special, professional taskforce ('commando').
   To effectively cope with and minimise the negative effects of certain catastrophic events – e.g., massive pollution of water resources, air or soil by industrial accidents or natural disasters – professional taskforces ('commandos') should be organised. These groups, in the event of an emergency, can be mobilised immediately to help the authorities in charge of counteractions with their advice and expertise. For the implementation of this recommendation, close and daily cooperation between the authorities and the given professional field (e.g. researchers and industry experts) is a precondition.

8. Non-renewable natural assets should also be protected by a well-functioning legal regulatory framework.
   According to representatives of 'mild' sustainability, within certain limits economic and natural assets can be replaced by each other in the process of social and economic wealth-creation. Even if we accept this view, there are still certain natural assets in our world that could not be replaced if they vanished or suffered irreparable damage. For this reason it is important to classify all human activities, bearing in mind the above consideration. For cases when 'classification checks' indicate that there is a potential danger of causing irreplaceable damage to the flora/fauna or landscape, the possibility of an environmental 'veto' – guaranteed under the law – should be established. Due to the high costs involved, the prime responsibility for establishing and operating gene banks rests with the government. However, maintaining gene banks seems to be possible as a profit-based operation, too.

9. In R&D activities research into environmental technologies and adaptation of clean technologies should be made a priority.
   Based on the present tendencies, the following areas deserve special attention:
   - The so-called cycle-ending technologies[4]
   - Within recycling technologies – dominated today by physical treatment – chemical recycling should receive more attention.
   - In the next decade we can expect the emergence of fuel cell technologies (e.g., hydrogen fuel cells). Hungarian researchers can join in the international R&D

[4] Technologies that complete the natural cycles interrupted by human intervention (e.g. continuous substitution of organic materials in the soil, or chemical recycling of atmospheric carbon dioxide.

work related to this and it is also their task to help domestic industry prepare for manufacturing these new devices.

- Development and application of simulation methods and models for forecasting the impacts of environment-related decisions and actions.
- Biotechnology will play an increasing role in cleaning up polluted sites and waste neutralisation. For example, the application of bacteria in cleaning up oil-polluted soil can be extended to other toxic organic pollutants (e.g., PCB and chlorine benzols).
- Efforts to avoid production of hazardous wastes or minimising their amount during economic activities should become general practice internationally as well as domestically.[5] Simultaneously, we have to develop and introduce new, substitute industrial processes and materials that are more environmentally friendly.
- A complex system of sustainable development indicators should be elaborated for continuous monitoring of the environment. Adequate operation of this complex monitoring system (creating the necessary database and continuous monitoring of changes) requires the development and application of remote-sensing tools and widespread use of GIS systems.

10. In setting priorities for the domestic environmental industry, the potential needs and market demand of neighbouring countries – first of all, Russia and Ukraine - should be taken into consideration.

The given region can be considered as a potential market of environmental technologies for two reasons. It is likely that within 20 years, in other words, the time-horizon of our analysis, new social and economic measures aimed at modernisation will be adopted in the region, and these will undoubtedly include efforts to improve the state of the environment. In the beginning, due to the lack of capital, so-called 'end-of-pipe' technologies will be preferred. This tendency can create a market pull for the Hungarian environmental industry. The other reason for increasing environmental market demand in the region is for cleaning up polluted sites. The need for cleaning-up and neutralisation technologies will depend heavily on the budget situation of the given countries. Taking into consideration the risks involved in doing business in the region – which exceed average levels – governmental financial guarantees should play an important role in the medium term. Concluding intergovernmental environmental agreements with the countries of the region can facilitate the implementation of the relevant recommendations.

[5] Gradual withdrawal of chlorine-based solvents from laboratories and eliminating any kind of cadmium use are good examples of this.